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COUNTRY

OKI ELECTRIC IND CO LTD

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ABSTRACT:

PURPOSE: To solve also a thermal problem while an interference between an optical transmission circuit and an optical reception circuit is prevented from being generated and to contribute to the improvement of the mounting density of a transmission-reception integral type optical transmission-reception module.

CONSTITUTION: In a transmission-reception integral type optical transmission-

reception module formed by integrally constituting an optical transmitter having an electrical signal/light signal conversion function and an optical receiver having a light signal/electrical signal conversion function, a circuit board 1, using a metal as a base material, is used, an optical transmission circuit 2 having an electrical signal/light signal conversion function is formed on one side of the board 11, an optical reception circuit 3 having a light signal/electrical signal conversion function is formed on the other side of the board 11 and the metal base material is set as a ground potential or a

power potential.

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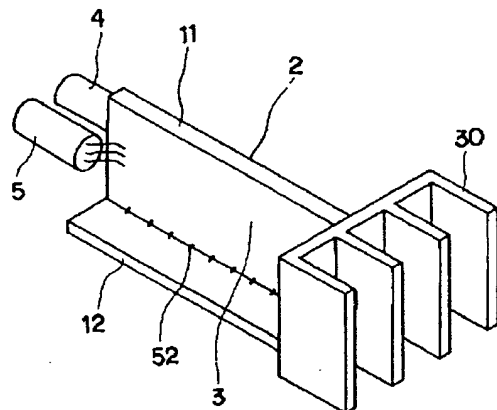
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(54) 【発明の名称】 送受一体型光送受信モジュール

(57) 【要約】

【目的】 各回路間の干渉を防止しながら熱的問題をも解決し、実装密度の向上に寄与することを目的とする。

【構成】 電気信号／光信号変換機能をもつ光送信機と、光信号／電気信号変換機能をもつ光受信機を一体化した、送受一体型光送受信モジュールにおいて、金属を基材とした回路基板11を使用し、その片面に電気信号／光信号変換機能をもつ光送信回路2を、もう一方の面に光信号／電気信号変換機能をもつ光受信回路3を形成し、前記金属基材をグランドまたは電源電位とする。



2 : 送信部回路 11 : 回路基板  
3 : 受信部回路 12 : 第2の回路基板  
4 : 発光素子 30 : 放熱部  
5 : 受光素子

本発明の第1の実施例の基本構造部分を示す斜視図

## 【特許請求の範囲】

【請求項1】 電気信号／光信号変換機能をもつ光送信機と、光信号／電気信号変換機能をもつ光受信機を一体化した、送受一体型光送受信モジュールにおいて、金属を基材とした回路基板を使用し、その片面に電気信号／光信号変換機能をもつ光送信回路を、もう一方の面に光信号／電気信号変換機能をもつ光受信回路を形成し、前記金属基材をグランドまたは電源電位としたことを特徴とする送受一体型光送受信モジュール。

【請求項2】 前記回路基板に、これと熱的に接続された金属製の放熱部を設けたことを特徴とする請求項1項記載の送受一体型光送受信モジュール。

【請求項3】 前記放熱部が、前記回路基板に電気的に接続されていることを特徴とする請求項2項記載の送受一体型光送受信モジュール。

【請求項4】 前記回路基板に対し垂直方向に取り付けられた第2の回路基板を有し、該第2の回路基板に形成された回路パターンの少なくともひとつの層をグランドまたは電源電位としたことを特徴とする請求項1～3項記載の送受一体型光送受信モジュール。

【請求項5】 周囲を導電性の筐体で覆ったことを特徴とする請求項1～4項記載の送受一体型光送受信モジュール。

## 【発明の詳細な説明】

## 【0001】

【産業上の利用分野】電気信号／光信号変換機能をもつ光送信機と、光信号／電気信号変換機能をもつ光受信機を一体化した、送受一体型光送受信モジュールに関する。

## 【0002】

【従来の技術】図5はこの種の送受一体型光送受信モジュールの第1の従来例を示す斜視図である。図において、1は回路基板であり、このひとつの回路基板上に送信部回路2と受信部回路3が取り付けられている。4は前記送信部回路2に接続した発光素子、5は前記受信部回路3に接続した受光素子である。

【0003】ここで、上述した如く、同一回路基板上に送信部回路と受信部回路が存在する実装形態においては、送信信号が互いに干渉しないようにする必要がある。そこで、前記送信部回路2と受信部回路3の間にシールド板6を設け、このシールド板6により各回路の間を電磁遮断し、互いの回路の干渉を防いでいた。図6はこの種の送受一体型光送受信モジュールの第2の従来例を示す斜視図である。

【0004】図において、1は回路基板であり、このひとつの回路基板上に送信部回路2と受信部回路3が取り付けられている。4は前記送信部回路2に接続した発光素子、5は前記受信部回路3に接続した受光素子である。第2の従来例においては、送受互いの回路が干渉しないように、各回路間に幅の広いグランドパターン7を

置き、このグランドパターン7により各回路の間を電磁遮断し、互いの回路の干渉を防いでいた。

## 【0005】

【発明が解決しようとする課題】しかしながら、上述した構成の従来技術によれば、基板を通じた放熱であるので、装置全体を小型化し実装密度を上げた場合には、基板の熱抵抗の大きさが無視できなくなり、半導体装置の接合温度を信頼性の保てる水準まで低下させることができなくなるという問題があった。

【0006】本発明は、以上の問題点を鑑み、各回路間の電磁遮断をするとともに総合的な熱抵抗を大幅に減少させる構成を得て、各回路間の干渉を防止しながら熱的問題をも解決し、実装密度の向上に寄与することを目的とする。

## 【0007】

【課題を解決するための手段】上記目的を達成するため、本発明は、送受信回路を搭載する一つの回路基板が、電磁遮断機能及び積極的な放熱機能を具備するようにする。すなわち、本発明は、電気信号／光信号変換機能をもつ光送信機と、光信号／電気信号変換機能をもつ光受信機を一体化した、送受一体型光送受信モジュールにおいて、金属を基材とした回路基板を使用し、その片面に電気信号／光信号変換機能をもつ光送信回路を、もう一方の面に光信号／電気信号変換機能をもつ光受信回路を形成し、前記金属基材をグランドまたは電源電位としたことを特徴とする。

【0008】このとき、前記回路基板に、これと熱的に接続された金属製の放熱部を設けると良い。また、前記放熱部が、前記回路基板に電気的に接続されていると良い。さらに、前記回路基板に対し垂直方向に第2の回路基板を取り付け、この第2の回路基板に形成された回路パターンの少なくともひとつの層をグランドまたは電源電位とすると良い。

【0009】さらに、周囲を導電性の筐体で覆うと良い。

## 【0010】

【作用】以上の構成の本発明によれば、回路基板の基材はグランドまたは電源電位であることから両面の各回路に対して電磁遮蔽板として機能する。さらに回路基板の基材は金属であることから、その特性としての高い熱伝導性により放熱の効率を高めることができる。

【0011】このとき、前記回路基板に、これと熱的に接続された金属製の放熱部を設けると、回路基板から効率良く伝導されてきた熱をさらに効率良く前記放熱部より大気へ放熱することができる。また、前記放熱部が、前記回路基板に電気的に接続されていると、放熱部も電磁遮蔽の役割を果たすことができる。

【0012】さらに、前記回路基板に対し垂直方向に第2の回路基板を取り付け、この第2の回路基板に形成された回路パターンの少なくともひとつの層をグランドま

たは電源電位とすると、前記第2の回路基板も電磁遮蔽の役割を果たすことができる。さらに、周囲を導電性の筐体で覆うと、この筐体が電磁遮蔽の役割を果たすことができる。

【0013】

【実施例】以下、図面に従って、実施例を説明する。図1は本発明の第1の実施例の基本構造部分を示す斜視図、図2は同実施例の外観を示す斜視図、図3は図2のA-A線断面図である。図において、11は基材に金属を使用した回路基板であり、該回路基板11の金属基材をグランドまたは電源電位とする。本実施例では回路基板11の基材にアルミニウムを使用しており、その面を絶縁層で覆う。そしてその絶縁層の上に導体層により回路パターンが形成されている。さらに、その表面は部品と電気的接続及び半導体装置搭載のために必要な部分を除き第2の絶縁層により絶縁されている。回路構成に応じ、さらに第2の絶縁層の上に第2の導体層および第3の絶縁層を形成した。前記導体層および絶縁層の総数は本発明に制限を加えるものではなく、それ以上であってもよいし、あるいはそれ以上の積層構造をとってもよい。

【００１４】なお、本実施例では基材としてアルミニウムを使用した。これに限るものではなく、銅、鉄あるいはそれ以外の金属でも良い。２は該回路基板１の片面に形成した電気信号／光信号変換機能をもつ送信部回路、３は前記回路基板１のもう一方の面に形成した光信号／電気信号変換機能をもつ受信部回路、４は前記送信部回路２に接続した発光素子、５は前記受信部回路３に接続した受光素子である。２１は送信側で使用する半導体装置、２２は受信側で使用する半導体装置を示している。なお、図１は基本構造のみを示すものである。これら半導体装置２１、２２の図示は省略してある。さらに、半導体装置２１、２２以外の電気部品については本発明に対して重要でない。図より省略してある。

【0015】なお、図1では、送信部回路2が向かって右側、受信部回路3が向かって左側になるように記載したが、この逆であってもよい。12は前記回路基板11に対し垂直方向にハンダ51、52により接続した第2の回路基板であり、該第2の回路基板12は電気部品搭載および端子60を介して外部回路との接続を行うと同時に、電磁遮蔽効果を持たせるために2層構造とし、その形成された回路パターンの少なくともひとつの層をグランドまたは電源電位とする。

【0016】前記回路基板11と第2の回路基板12の間は、本実施例ではハンダ51、52で接続したが、接続手段はハンダに限るものではない。30は前記回路基板11と熱的に接続された金属製の放熱部で有り、該放熱部30は前記発光素子4と受光素子5に反する側即ち本装置後部で回路基板11上の集積回路で発生する熱を

大氣に放熱する。

【００１７】４０は図１で示す基本構造の周囲を覆った筐体であり、該筐体４０は導電性の材料で形成されている。以上の構成の第１の実施例の作用は以下の如くである。すなわち、回路基板１１の基材はグラウンドまたは電源電位であることから両面に分離して配線した送信部回路２と受信部回路３の各回路に対して電磁遮蔽板として働く。さらに、半導体装置２１，２２で発生する熱は、熱伝導性に優れた基板１１の基材を通じて流れ、その多くの部分は放熱部３０から大気に放熱される。

【0018】この時、第2の回路基板12はその形成された回路パターンの少なくともひとつの層をグランドまたは電源電位としているので、該第2の回路基板12も送信部回路2と受信部回路3の各回路に対して電磁遮蔽板として働く。さらに、導電性の材料で形成された筐体40も、送信部回路2と受信部回路3の各回路に対して電磁遮蔽板として働く。

【0019】上述した第1の実施例により、従来およそ  $25\text{mm} \times 30\text{mm} \times 8\text{mm} = 6000\text{mm}^3$  であった光送信受信モジュールを  $10\text{mm} \times 10\text{mm} \times 40\text{mm} = 4000\text{mm}^3$  の容量に小型化できた。また、本実施例により、従来低温焼成セラミック基板を使用していた装置に比べ、約六十分の一の熱抵抗となり、 $10\text{mm}$  角、フィン高さ  $10\text{mm}$  4枚の放熱フィンを接続した  $300\text{mm}^2$  の基板に  $0.5\text{W}$  の半導体装置を2個搭載した場合の温度上昇は  $10^\circ\text{C}$  以下であり、小型化に対して十分な効果があった。また、電磁遮蔽効果については、送信部の影響による最小受光感度低下は受信レベル  $-23\text{dBm}$  において  $0.2\text{dB}$  以下であり、十分な電磁遮蔽効果を得ることができた。

【００２０】図４は本発明の第２の実施例の基本構造部分を示す斜視図である。第２の実施例においては回路基板１１の上部に回路基板１１に対し熱的、電気的に接続したアルミニウム製の放熱部３１を設けてある。他の構成は第１の実施例と同様であるので説明は省略し、符号も同一のものを使用する。以上の構成による本実施例の作用は以下の如くである。

【0021】回路基板11の両側にそれぞれ形成された送信部回路2および受信部回路3で発生した熱は、回路基板11の上部に設けたアルミニウムで作られた放熱部31より大気に放出される。さらに、回路基板11の基材であるアルミニウムは電気回路のグランドに接続され、送信部回路2と受信部回路3の電磁遮蔽の役割を果たしているが、この実施例の場合は、放熱部31も回路基板11と電気的に接続されているので、放熱部31も電磁遮蔽の役割を果たしている。

【0022】第2の実施例においては、従来6000mm<sup>3</sup>であった容量を、10mm×16mm×30mm=4800mm<sup>3</sup>に小型化できた。さらに、本実施例では放熱部31の放熱面積が広くでき、かつ発熱部からの距

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離が短く、また回路基板11と放熱部31との接続部断面積が大きくとれたため、第1の実施例の場合よりも放熱特性に優れている効果を示し、温度上昇は4°C以下であった。

【0023】また、電磁遮蔽効果についても第1の実施例と同様であることが確認された。

【0024】

【発明の効果】以上詳細に説明した如く、本発明によれば、電気信号／光信号変換機能をもつ光送信機と、光信号／電気信号変換機能をもつ光受信機を一体化した、送受一体型光送受信モジュールにおいて、金属を基材とした回路基板を使用し、その片面に電気信号／光信号変換機能をもつ光送信回路を、もう一方の面に光信号／電気信号変換機能をもつ光受信回路を形成し、前記金属基材をグランドまたは電源電位としたので、送受信回路を搭載する一つの回路基板が、電磁遮断機能及び積極的な放熱機能を具備することができる。

【0025】これにより、各回路間の電磁遮断をするとともに総合的な熱抵抗を大幅に減少させることが可能となり、各回路間の干渉を防止しながら熱的問題をも解決し、実装密度の向上に寄与するという効果がある。このとき、前記回路基板に、これと熱的に接続された金属製の放熱部を設けると、回路基板から効率良く伝導されてきた熱をさらに効率良く前記放熱部より大気へ放熱することができるので、放熱効果がさらに高まるという効果がある。

【0026】また、前記放熱部が、前記回路基板に電気的に接続されていると、放熱部も電磁遮蔽の役割を果たすことができ、電磁遮蔽効果が更に高まるという効果がある。さらに、前記回路基板に対し垂直方向に第2の回

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路基板を取り付け、この第2の回路基板に形成された回路パターンの少なくともひとつの層をグランドまたは電源電位とすると、前記第2の回路基板も電磁遮蔽の役割を果たすことができ、電磁遮蔽効果が更に高まるという効果がある。

【0027】さらに、周囲を導電性の筐体で覆うと、この筐体が電磁遮蔽の役割を果たすことができ、電磁遮蔽効果が更に高まるという効果がある。

【図面の簡単な説明】

【図1】本発明の第1の実施例の基本構造部分を示す斜視図である。

【図2】本発明の第1の実施例の外観を示す斜視図である。

【図3】図2のA-A線断面図である。

【図4】本発明の第2の実施例の基本構造部分を示す斜視図である。

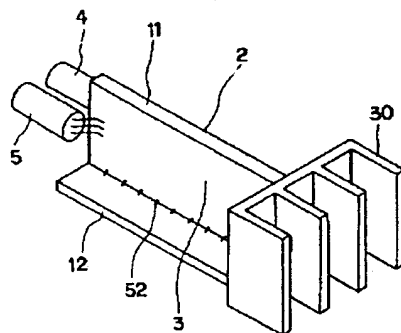
【図5】第1の従来例を示す斜視図である。

【図6】第2の従来例を示す斜視図である。

【符号の説明】

- 2 送信部回路
- 3 受信部回路
- 4 発光素子
- 5 受光素子
- 11 回路基板
- 12 第2の回路基板
- 21, 22 半導体装置
- 30 放熱部
- 40 筐体
- 51, 52 ハンダ
- 60 端子

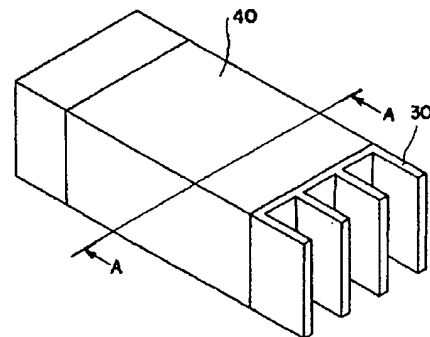
【図1】



- 2: 送信部回路
- 3: 受信部回路
- 4: 発光素子
- 5: 受光素子
- 11: 回路基板
- 12: 第2の回路基板
- 30: 放熱部

本発明の第1の実施例の基本構造部分を示す斜視図

【図2】



本発明の第1の実施例の外観を示す斜視図

【図3】

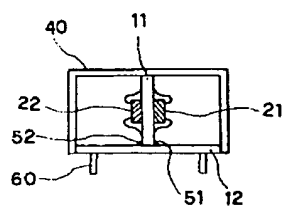
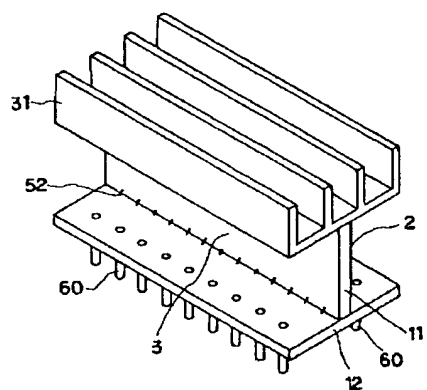


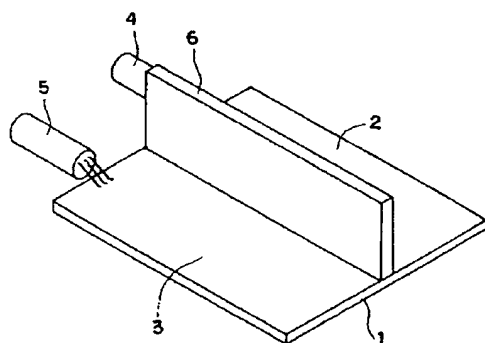
図2のA-A線断面図

【図4】



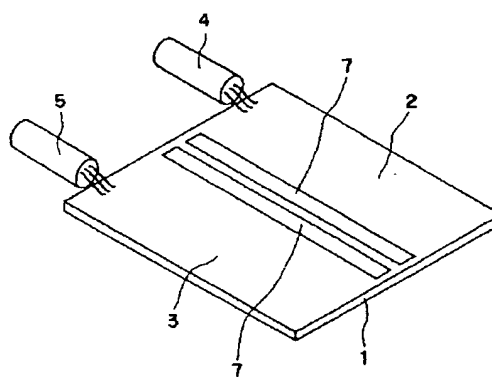
本発明の第2の実施例の基本構造部分を示す斜視図

【図5】



第1の従来例を示す斜視図

【図6】



第2の従来例を示す斜視図



# PATENT ABSTRACTS OF JAPAN

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(21)Application number : 07-126287

(71)Applicant : OKI ELECTRIC IND CO LTD

(22)Date of filing : 25. 05. 1995

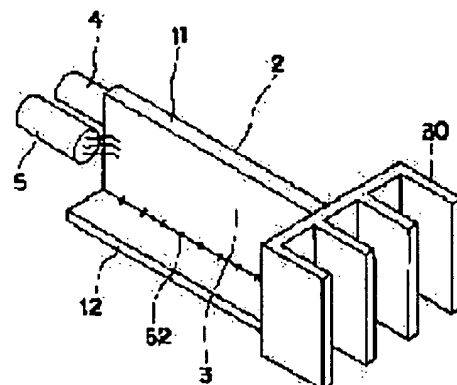
(72)Inventor : KUBOTA TAKASHI

(54) TRANSMISSION-RECEPTION INTEGRAL TYPE OPTICAL TRANSMISSION /RECEPTION MODULE

(57)Abstract:

PURPOSE: To solve also a thermal problem while an interference between an optical transmission circuit and an optical reception circuit is prevented from being generated and to contribute to the improvement of the mounting density of a transmission-reception integral type optical transmission-reception module.

CONSTITUTION: In a transmission-reception integral type optical transmission-reception module formed by integrally constituting an optical transmitter having an electrical signal/light signal conversion function and an optical receiver having a light signal/electrical signal conversion function, a circuit board 1, using a metal as a base material, is used, an optical transmission circuit 2 having an electrical signal/light signal conversion function is formed on one side of the board 11, an optical reception circuit 3 having a light signal/electrical signal conversion function is formed on the other side of the board 11 and the metal base material is set as a ground potential or a power potential.



## LEGAL STATUS

[Date of request for examination]

[Date of sending the examiner's decision of rejection]

[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]

[Date of final disposal for application]

[Patent number]

[Date of registration]

[Number of appeal against examiner's  
decision of rejection]

[Date of requesting appeal against  
examiner's decision of rejection]

[Date of extinction of right]

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CLAIMS

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[Claim(s)]

[Claim 1] In the transmission-and-reception one apparatus light transceiver module which unified the optical transmitter with an electrical signal / lightwave signal conversion function, and the optical receiver with a lightwave signal / electrical signal conversion function The transmission-and-reception one apparatus light transceiver module characterized by having used the circuit board which made the metal the base material, having formed the optical receiving circuit which has a lightwave signal / electrical signal conversion function for the optical sending circuit which has an electrical signal / lightwave signal conversion function in the one side in another field, and making the aforementioned metal base into a gland or power potential.

[Claim 2] The transmission-and-reception one apparatus light transceiver module given in claim 1 term characterized by preparing the metal thermolysis section thermally connected with this in the aforementioned circuit board.

[Claim 3] The transmission-and-reception one apparatus light transceiver module given in claim dyadic characterized by connecting the aforementioned thermolysis section to the aforementioned circuit board electrically.

[Claim 4] A transmission-and-reception one apparatus light transceiver module the claim 1 characterized by making into a gland or power potential at least one layer of the circuit pattern which has the 2nd circuit board perpendicularly attached to the aforementioned circuit board, and was formed in this 2nd circuit board, - given in 3 terms.

[Claim 5] A transmission-and-reception one apparatus light transceiver module the claim 1 characterized by covering the periphery by the conductive case, - given in 4 terms.

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## DETAILED DESCRIPTION

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### [Detailed Description of the Invention]

[0001]

[Field of the Invention] It is related with the transmission-and-reception one apparatus light transceiver module which unified the optical transmitter with an electrical signal / lightwave signal conversion function, and the optical receiver with a lightwave signal / electrical signal conversion function.

[0002]

[Description of the Prior Art] Drawing 5 is a perspective diagram showing the 1st conventional example of this kind of transmission-and-reception one apparatus light transceiver module. In drawing, 1 is the circuit board and the transmitting section circuit 2 and the receive-section circuit 3 are attached on this one circuit board. The light emitting device which connected 4 to the aforementioned transmitting section circuit 2, and 5 are the photo detectors linked to the aforementioned receive-section circuit 3.

[0003] As mentioned above, in the package gestalt to which a transmitting section circuit and a receive-section circuit exist on the same circuit board, a sending signal needs to be made not to interfere here mutually. then, between the aforementioned transmitting section circuit 2 and the receive-section circuits 3 -- the shield plate 6 -- preparing -- this shield plate 6 -- between each circuit -- electromagnetism -- it intercepted and the interference of a mutual circuit was prevented Drawing 6 is a perspective diagram showing the 2nd conventional example of this kind of transmission-and-reception one apparatus light transceiver module.

[0004] In drawing, 1 is the circuit board and the transmitting section circuit 2 and the receive-section circuit 3 are attached on this one circuit board. The light emitting device which connected 4 to the aforementioned transmitting section circuit 2, and 5 are the photo detectors linked to the aforementioned receive-section circuit 3. the 2nd conventional example -- setting -- transmission and reception -- a mutual circuit does not interfere -- as -- between each circuit -- the grand pattern 7 with wide width of face -- placing -- this grand pattern 7 -- between each circuit -- electromagnetism -- it intercepted and the interference of a mutual circuit was prevented

[0005]

[Problem(s) to be Solved by the Invention] However, since it was the thermolysis which passed the substrate according to the conventional technique of a configuration of having mentioned above, when the whole equipment was miniaturized and packaging density was raised, there was a problem of the ability not to make it come to fall to the level at which it becomes impossible to ignore the size of the thermal resistance of a substrate, and a reliability can maintain the virtual junction temperature of a semiconductor device.

[0006] the trouble of a more than [ this invention ] -- taking an example -- the electromagnetism between each circuit -- a thermal problem is also solved, obtaining the configuration which decreases synthetic thermal resistance sharply, and preventing the interference between each circuit, while intercepting, and it aims at contributing to the enhancement in packaging density

[0007]

[Means for Solving the Problem] the one circuit board in which this invention carries a transceiver circuit in order to attain the above-mentioned purpose -- electromagnetism -- a cutoff function and a positive thermolysis function are provided. Namely, this invention is set to the transmission-and-reception one apparatus light transceiver module which unified the optical transmitter with an electrical signal / lightwave signal conversion function, and the optical receiver with a lightwave signal / electrical signal conversion function. The circuit board which made the metal the base material is used, the optical receiving circuit which has a lightwave signal / electrical signal conversion function for the optical sending circuit which has an electrical signal / lightwave signal conversion function in the one side in another field is formed, and it is characterized by making the aforementioned metal base into a gland or power potential.

[0008] At this time, it is good to prepare the metal thermolysis section thermally connected with this in the aforementioned circuit board. Moreover, it is good to connect the aforementioned thermolysis section to the aforementioned circuit board electrically. Furthermore, it is good to make into a gland or power potential at least one layer of the circuit pattern which attaches the 2nd circuit board perpendicularly to the aforementioned circuit board, and was formed in this 2nd circuit board.

[0009] Furthermore, it is as good as a wrap in the periphery at a conductive case.

[0010]

[Function] According to this invention of the above configuration, since the base material of the circuit board is a gland or power potential, it functions as an electromagnetic-shielding plate to each double-sided circuit. Furthermore, since the base material of the circuit board is a metal, it can raise the luminous efficacy of thermolysis with the high thermal conductivity as the property.

[0011] If the metal thermolysis section thermally connected with this is prepared in the aforementioned circuit board at this time, heat can be radiated from the aforementioned thermolysis section to the atmospheric air still efficiently in the heat efficiently conducted from the circuit board. Moreover, if the aforementioned thermolysis section is electrically connected to the aforementioned circuit board, the thermolysis section can also play the role of electromagnetic shielding.

[0012] Furthermore, the 2nd circuit board is perpendicularly attached to the aforementioned circuit board, and if at least one layer of the circuit pattern formed in this 2nd circuit board is made into a gland or power potential, the 2nd aforementioned circuit board can also play the role of electromagnetic shielding. Furthermore, this case can play the role of electromagnetic shielding for the periphery with a wrap by the conductive case.

[0013]

[Example] Hereafter, an example is explained according to a drawing. The perspective diagram showing [ 1 ] a part for the basic structured division of the 1st example of this invention, the perspective diagram showing [ 2 ] the appearance of this example, and the drawing 3 are A-A line cross sections of drawing 2. In drawing, 11 is the circuit board which used the metal for the base material, and makes the metal base of this circuit board 11 a gland or power potential. In this example, aluminum is used for the base material of the circuit board 11, and the field is worn by the insulating layer. And the circuit pattern is formed of the conductor layer on the insulating layer. Furthermore, the front face is insulated by the 2nd insulating layer except for the fraction required because of parts, electrical installation, and semiconductor device loading. According to circuit arrangement, the 2nd conductor layer and the 3rd insulating layer were further formed on the 2nd insulating layer. The total of the aforementioned conductor layer and an insulating layer does not add a limit to this invention, may be more than it or may take the laminated structure beyond it.

[0014] In addition, although aluminum was used as a base material in this example, it may not restrict to this and copper, iron, or the other metal is sufficient. The transmitting section circuit with the electrical signal / lightwave signal conversion function which formed 2 in one side of this circuit board 11, and 3 are the receive-section circuit with the lightwave signal / electrical signal conversion function which while would accept and was formed in the field, the light emitting device which

connected 4 to the aforementioned transmitting section circuit 2, and the photo detector which connected 5 to the aforementioned receive-section circuit 3 aforementioned circuit board 11. The semiconductor device which uses 21 by the transmitting side, and 22 show the semiconductor device used by the receiving side. In addition, since drawing 1 shows only basic structure, illustration of these semiconductor devices 21 and 22 has been omitted. Furthermore, about electrical parts other than a semiconductor device 21 and 22, to this invention, since it is not important, it has omitted from drawing.

[0015] In addition, you may be this reverse although drawing 1 indicated that the transmitting section circuit 2 went, right-hand side and the receive-section circuit 3 went, and it became left-hand side. 12 is the 2nd circuit board perpendicularly connected with pewters 51 and 52 to the aforementioned circuit board 11, and this 2nd circuit board 12 considers as two-layer structure, in order to give the electromagnetic-shielding effect, and makes at least one layer of the formed circuit pattern a gland or power potential at the same time it makes connection with an external circuit through electrical-part loading and the terminal 60.

[0016] Although it connected with pewters 51 and 52 by this example between the aforementioned circuit board 11 and the 2nd circuit board 12, a connection means is not restricted to a pewter. There is 30 in the metal thermolysis section thermally connected with the aforementioned circuit board 11, and this thermolysis section 30 radiates heat to the atmospheric air in the heat which occurs by the integrated circuit on the circuit board 11, the side, i.e., this equipment posterior part, contrary to the aforementioned light emitting device 4 and the photo detector 5.

[0017] 40 is the case which covered the periphery of the basic structure shown in drawing 1, and this case 40 is formed with the conductive material. an operation of the 1st example of the above configuration comes out as the following That is, since the base material of the circuit board 11 is a gland or power potential, it works as an electromagnetic-shielding plate to each circuit of the transmitting section circuit 2 and the receive-section circuit 3 which dissociated and wired both sides. Furthermore, the heat which occurs with semiconductor devices 21 and 22 flows through the base material of a substrate 11 excellent in thermal conductivity, and the fraction of the many radiates heat from the thermolysis section 30 to the atmospheric air.

[0018] Since the 2nd circuit board 12 makes at least one layer of the formed circuit pattern a gland or power potential at this time, this 2nd circuit board 12 also works as an electromagnetic-shielding plate to each circuit of the transmitting section circuit 2 and the receive-section circuit 3.

Furthermore, the case 40 formed with the conductive material also works as an electromagnetic-shielding plate to each circuit of the transmitting section circuit 2 and the receive-section circuit 3.

[0019] the 1st example mentioned above -- the former -- about 25 --  $\text{mm} \times 30\text{mm} \times 8\text{mm} = 6000\text{mm}^3$  it was -- an optical transmitting receiving module --  $10\text{mm} \times 10\text{mm} \times 40\text{mm} = 4000\text{mm}^3$  It has miniaturized in capacity. Moreover,  $300\text{mm}^2$  which became the thermal resistance of about  $1/60$ , and connected the with 10mm angle and a fin height [ 10mm / four sheet ] radiation fin by this example compared with the equipment which was using the low-temperature baking ceramic substrate conventionally The temperature rise at the time of carrying two semiconductor devices of 0.5W in a substrate is below 10 degreeC, and had sufficient effect to the miniaturization. Moreover, the minimum light-receiving photographic-sensitivity fall according to the influence of the transmitting section about the electromagnetic-shielding effect is receiving level. - In 23dBm, it is 0.2dB or less, and sufficient electromagnetic-shielding effect was able to be acquired.

[0020] Drawing 4 is a perspective diagram showing a part for the basic structured division of the 2nd example of this invention. The thermolysis section 31 made from aluminum connected to the upper part of the circuit board 11 thermally and electrically to the circuit board 11 in the 2nd example is formed. Since other configurations are the same as that of the 1st example, an explanation is omitted and a sign also uses the same thing. an operation of this example by the above configuration comes out as the following

[0021] The heat which occurred in the transmitting section circuit 2 and the receive-section circuit 3

which were formed in the both sides of the circuit board 11, respectively is emitted to the atmospheric air from the thermolysis section 31 made from the aluminum prepared in the upper part of the circuit board 11. Furthermore, in the case of this example, although the aluminum which is the base material of the circuit board 11 is connected to the gland of an electrical circuit and the role of electromagnetic shielding of the transmitting section circuit 2 and the receive-section circuit 3 is played, since the thermolysis section 31 is also electrically connected with the circuit board 11, the thermolysis section 31 has also played the role of electromagnetic shielding.

[0022] the 2nd example -- setting -- conventional 6000mm<sup>3</sup> it was -- capacity --

10mmx16mmx30mm=4800mm<sup>3</sup> It has miniaturized. Furthermore, in this example, the heat sinking plane product of the thermolysis section 31 was made widely, and \*\*\*\*\* which excels the case where it is the 1st example in the thermolysis property since the connection cross section of the circuit board 11 and the thermolysis section 31 is large and the distance from the exoergic section took short was shown, and the temperature rise was below 4 degreeC.

[0023] Moreover, it was checked that it is the same as that of the 1st example also about the electromagnetic-shielding effect.

[0024]

[Effect of the Invention] In the transmission-and-reception one apparatus light transceiver module which unified the optical transmitter with an electrical signal / lightwave signal conversion function, and the optical receiver with a lightwave signal / electrical signal conversion function according to this invention as explained to the detail above Since the circuit board which made the metal the base material was used, the optical receiving circuit which has a lightwave signal / electrical signal conversion function for the optical sending circuit which has an electrical signal / lightwave signal conversion function in the one side in another field was formed and the aforementioned metal base was made into a gland or power potential the one circuit board which carries a transceiver circuit -- electromagnetism -- a cutoff function and a positive thermolysis function can be provided

[0025] thereby -- the electromagnetism between each circuit -- while intercepting, with it being possible to decrease synthetic thermal resistance sharply, it becomes, and a thermal problem is also solved, preventing the interference between each circuit, and it is effective in contributing to the enhancement in packaging density If the metal thermolysis section thermally connected with this is prepared in the aforementioned circuit board at this time, since heat can be radiated from the aforementioned thermolysis section to the atmospheric air still efficiently in the heat efficiently conducted from the circuit board, it is effective in the thermolysis effect increasing further.

[0026] Moreover, when the aforementioned thermolysis section is electrically connected to the aforementioned circuit board, the thermolysis section can also play the role of electromagnetic shielding and is effective in the electromagnetic-shielding effect increasing further. Furthermore, the 2nd circuit board is perpendicularly attached to the aforementioned circuit board, and if at least one layer of the circuit pattern formed in this 2nd circuit board is made into a gland or power potential, the 2nd aforementioned circuit board can also play the role of electromagnetic shielding, and it is effective in the electromagnetic-shielding effect increasing further.

[0027] Furthermore, in the periphery, this case can play the role of electromagnetic shielding with a wrap by the conductive case, and it is effective in the electromagnetic-shielding effect increasing further.

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Field

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[Field of the Invention] It is related with the transmission-and-reception one apparatus light transceiver module which unified the optical transmitter with an electrical signal / lightwave signal conversion function, and the optical receiver with a lightwave signal / electrical signal conversion function.

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Technique

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[Description of the Prior Art] Drawing 5 is a perspective diagram showing the 1st conventional example of this kind of transmission-and-reception one apparatus light transceiver module. In drawing, 1 is the circuit board and the transmitting section circuit 2 and the receive-section circuit 3 are attached on this one circuit board. The light emitting device which connected 4 to the aforementioned transmitting section circuit 2, and 5 are the photo detectors linked to the aforementioned receive-section circuit 3.

[0003] As mentioned above, in the package gestalt to which a transmitting section circuit and a receive-section circuit exist on the same circuit board, a sending signal needs to be made not to interfere here mutually. then, between the aforementioned transmitting section circuit 2 and the receive-section circuits 3 -- the shield plate 6 -- preparing -- this shield plate 6 -- between each circuit -- electromagnetism -- it intercepted and the interference of a mutual circuit was prevented Drawing 6 is a perspective diagram showing the 2nd conventional example of this kind of transmission-and-reception one apparatus light transceiver module.

[0004] In drawing, 1 is the circuit board and the transmitting section circuit 2 and the receive-section circuit 3 are attached on this one circuit board. The light emitting device which connected 4 to the aforementioned transmitting section circuit 2, and 5 are the photo detectors linked to the aforementioned receive-section circuit 3. the 2nd conventional example -- setting -- transmission and reception -- a mutual circuit does not interfere -- as -- between each circuit -- the grand pattern 7 with wide width of face -- placing -- this grand pattern 7 -- between each circuit -- electromagnetism -- it intercepted and the interference of a mutual circuit was prevented

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Effect

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[Effect of the Invention] In the transmission-and-reception one apparatus light transceiver module which unified the optical transmitter with an electrical signal / lightwave signal conversion function, and the optical receiver with a lightwave signal / electrical signal conversion function according to this invention as explained to the detail above Since the circuit board which made the metal the base material was used, the optical receiving circuit which has a lightwave signal / electrical signal conversion function for the optical sending circuit which has an electrical signal / lightwave signal conversion function in the one side in another field was formed and the aforementioned metal base was made into a gland or power potential the one circuit board which carries a transceiver circuit -- electromagnetism -- a cutoff function and a positive thermolysis function can be provided

[0025] thereby -- the electromagnetism between each circuit -- while intercepting, with it being possible to decrease synthetic thermal resistance sharply, it becomes, and a thermal problem is also solved, preventing the interference between each circuit, and it is effective in contributing to the enhancement in packaging density If the metal thermolysis section thermally connected with this is prepared in the aforementioned circuit board at this time, since heat can be radiated from the aforementioned thermolysis section to the atmospheric air still efficiently in the heat efficiently conducted from the circuit board, it is effective in the thermolysis effect increasing further.

[0026] Moreover, when the aforementioned thermolysis section is electrically connected to the aforementioned circuit board, the thermolysis section can also play the role of electromagnetic shielding and is effective in the electromagnetic-shielding effect increasing further. Furthermore, the 2nd circuit board is perpendicularly attached to the aforementioned circuit board, and if at least one layer of the circuit pattern formed in this 2nd circuit board is made into a gland or power potential, the 2nd aforementioned circuit board can also play the role of electromagnetic shielding, and it is effective in the electromagnetic-shielding effect increasing further.

[0027] Furthermore, in the periphery, this case can play the role of electromagnetic shielding with a wrap by the conductive case, and it is effective in the electromagnetic-shielding effect increasing further.

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TECHNICAL PROBLEM

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[Problem(s) to be Solved by the Invention] However, since it was the thermolysis which passed the substrate according to the conventional technique of a configuration of having mentioned above, when the whole equipment was miniaturized and packaging density was raised, there was a problem of the ability not to make it come to fall to the level at which it becomes impossible to ignore the size of the thermal resistance of a substrate, and a reliability can maintain the virtual junction temperature of a semiconductor device.

[0006] the trouble of a more than [ this invention ] -- taking an example -- the electromagnetism between each circuit -- a thermal problem is also solved, obtaining the configuration which decreases synthetic thermal resistance sharply, and preventing the interference between each circuit, while intercepting, and it aims at contributing to the enhancement in packaging density

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MEANS

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[Means for Solving the Problem] the one circuit board in which this invention carries a transceiver circuit in order to attain the above-mentioned purpose -- electromagnetism -- a cutoff function and a positive thermolysis function are provided. Namely, this invention is set to the transmission-and-reception one apparatus light transceiver module which unified the optical transmitter with an electrical signal / lightwave signal conversion function, and the optical receiver with a lightwave signal / electrical signal conversion function. The circuit board which made the metal the base material is used, the optical receiving circuit which has a lightwave signal / electrical signal conversion function for the optical sending circuit which has an electrical signal / lightwave signal conversion function in the one side in another field is formed, and it is characterized by making the aforementioned metal base into a gland or power potential.

[0008] At this time, it is good to prepare the metal thermolysis section thermally connected with this in the aforementioned circuit board. Moreover, it is good to connect the aforementioned thermolysis section to the aforementioned circuit board electrically. Furthermore, it is good to make into a gland or power potential at least one layer of the circuit pattern which attaches the 2nd circuit board perpendicularly to the aforementioned circuit board, and was formed in this 2nd circuit board.

[0009] Furthermore, it is as good as a wrap in the periphery at a conductive case.

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OPERATION

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[Function] According to this invention of the above configuration, since the base material of the circuit board is a gland or power potential, it functions as an electromagnetic-shielding plate to each double-sided circuit. Furthermore, since the base material of the circuit board is a metal, it can raise the luminous efficacy of thermolysis with the high thermal conductivity as the property.

[0011] If the metal thermolysis section thermally connected with this is prepared in the aforementioned circuit board at this time, heat can be radiated from the aforementioned thermolysis section to the atmospheric air still efficiently in the heat efficiently conducted from the circuit board. Moreover, if the aforementioned thermolysis section is electrically connected to the aforementioned circuit board, the thermolysis section can also play the role of electromagnetic shielding.

[0012] Furthermore, the 2nd circuit board is perpendicularly attached to the aforementioned circuit board, and if at least one layer of the circuit pattern formed in this 2nd circuit board is made into a gland or power potential, the 2nd aforementioned circuit board can also play the role of electromagnetic shielding. Furthermore, this case can play the role of electromagnetic shielding for the periphery with a wrap by the conductive case.

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## EXAMPLE

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[Example] Hereafter, an example is explained according to a drawing. The perspective diagram showing [ 1 ] a part for the basic structured division of the 1st example of this invention, the perspective diagram showing [ 2 ] the appearance of this example, and the drawing 3 are A-A line cross sections of drawing 2. In drawing, 11 is the circuit board which used the metal for the base material, and makes the metal base of this circuit board 11 a gland or power potential. In this example, aluminum is used for the base material of the circuit board 11, and the field is worn by the insulating layer. And the circuit pattern is formed of the conductor layer on the insulating layer. Furthermore, the front face is insulated by the 2nd insulating layer except for the fraction required because of parts, electrical installation, and semiconductor device loading. According to circuit arrangement, the 2nd conductor layer and the 3rd insulating layer were further formed on the 2nd insulating layer. The total of the aforementioned conductor layer and an insulating layer does not add a limit to this invention, may be more than it or may take the laminated structure beyond it.

[0014] In addition, although aluminum was used as a base material in this example, it may not restrict to this and copper, iron, or the other metal is sufficient. The transmitting section circuit with the electrical signal / lightwave signal conversion function which formed 2 in one side of this circuit board 11, and 3 are the receive-section circuit with the lightwave signal / electrical signal conversion function which while would accept and was formed in the field, the light emitting device which connected 4 to the aforementioned transmitting section circuit 2, and the photo detector which connected 5 to the aforementioned receive-section circuit 3 aforementioned circuit board 11. The semiconductor device which uses 21 by the transmitting side, and 22 show the semiconductor device used by the receiving side. In addition, since drawing 1 shows only basic structure, illustration of these semiconductor devices 21 and 22 has been omitted. Furthermore, about electrical parts other than a semiconductor device 21 and 22, to this invention, since it is not important, it has omitted from drawing.

[0015] In addition, you may be this reverse although drawing 1 indicated that the transmitting section circuit 2 went, right-hand side and the receive-section circuit 3 went, and it became left-hand side. 12 is the 2nd circuit board perpendicularly connected with peters 51 and 52 to the aforementioned circuit board 11, and this 2nd circuit board 12 considers as two-layer structure, in order to give the electromagnetic-shielding effect, and makes at least one layer of the formed circuit pattern a gland or power potential at the same time it makes connection with an external circuit through electrical-part loading and the terminal 60.

[0016] Although it connected with peters 51 and 52 by this example between the aforementioned circuit board 11 and the 2nd circuit board 12, a connection means is not restricted to a peter. There is 30 in the metal thermolysis section thermally connected with the aforementioned circuit board 11, and this thermolysis section 30 radiates heat to the atmospheric air in the heat which occurs by the integrated circuit on the circuit board 11, the side, i.e., this equipment posterior part, contrary to the aforementioned light emitting device 4 and the photo detector 5.

[0017] 40 is the case which covered the periphery of the basic structure shown in drawing 1, and this

case 40 is formed with the conductive material. an operation of the 1st example of the above configuration comes out as the following That is, since the base material of the circuit board 11 is a gland or power potential, it works as an electromagnetic-shielding plate to each circuit of the transmitting section circuit 2 and the receive-section circuit 3 which dissociated and wired both sides. Furthermore, the heat which occurs with semiconductor devices 21 and 22 flows through the base material of a substrate 11 excellent in thermal conductivity, and the fraction of the many radiates heat from the thermolysis section 30 to the atmospheric air.

[0018] Since the 2nd circuit board 12 makes at least one layer of the formed circuit pattern a gland or power potential at this time, this 2nd circuit board 12 also works as an electromagnetic-shielding plate to each circuit of the transmitting section circuit 2 and the receive-section circuit 3.

Furthermore, the case 40 formed with the conductive material also works as an electromagnetic-shielding plate to each circuit of the transmitting section circuit 2 and the receive-section circuit 3.

[0019] the 1st example mentioned above -- the former -- about 25 -- mmx30mmx8mm=6000mm<sup>3</sup> it was -- an optical transmitting receiving module -- 10mmx10mmx40mm=4000mm<sup>3</sup> It has miniaturized in capacity. Moreover, 300mm<sup>2</sup> which became the thermal resistance of about 1/60, and connected the with 10mm angle and a fin height [ 10mm / four sheet ] radiation fin by this example compared with the equipment which was using the low-temperature baking ceramic substrate conventionally The temperature rise at the time of carrying two semiconductor devices of 0.5W in a substrate is below 10 degreeC, and had sufficient effect to the miniaturization. Moreover, the minimum light-receiving photographic-sensitivity fall according to the influence of the transmitting section about the electromagnetic-shielding effect is receiving level. - In 23dBm, it is 0.2dB or less, and sufficient electromagnetic-shielding effect was able to be acquired.

[0020] Drawing 4 is a perspective diagram showing a part for the basic structured division of the 2nd example of this invention. The thermolysis section 31 made from aluminum connected to the upper part of the circuit board 11 thermally and electrically to the circuit board 11 in the 2nd example is formed. Since other configurations are the same as that of the 1st example, an explanation is omitted and a sign also uses the same thing. an operation of this example by the above configuration comes out as the following

[0021] The heat which occurred in the transmitting section circuit 2 and the receive-section circuit 3 which were formed in the both sides of the circuit board 11, respectively is emitted to the atmospheric air from the thermolysis section 31 made from the aluminum prepared in the upper part of the circuit board 11. Furthermore, in the case of this example, although the aluminum which is the base material of the circuit board 11 is connected to the gland of an electrical circuit and the role of electromagnetic shielding of the transmitting section circuit 2 and the receive-section circuit 3 is played, since the thermolysis section 31 is also electrically connected with the circuit board 11, the thermolysis section 31 has also played the role of electromagnetic shielding.

[0022] the 2nd example -- setting -- conventional 6000mm<sup>3</sup> it was -- capacity -- 10mmx16mmx30mm=4800mm<sup>3</sup> It has miniaturized. Furthermore, in this example, the heat sinking plane product of the thermolysis section 31 was made widely, and \*\*\*\*\* which excels the case where it is the 1st example in the thermolysis property since the connection cross section of the circuit board 11 and the thermolysis section 31 is large and the distance from the exoergic section took short was shown, and the temperature rise was below 4 degreeC.

[0023] Moreover, it was checked that it is the same as that of the 1st example also about the electromagnetic-shielding effect.

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[Translation done.]

\* NOTICES \*

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- 2.\*\*\*\* shows the word which can not be translated.
- 3.In the drawings, any words are not translated.

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## DESCRIPTION OF DRAWINGS

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[Brief Description of the Drawings]

[Drawing 1] It is the perspective diagram showing a part for the basic structured division of the 1st example of this invention.

[Drawing 2] It is the perspective diagram showing the appearance of the 1st example of this invention.

[Drawing 3] It is the A-A line cross section of drawing 2 .

[Drawing 4] It is the perspective diagram showing a part for the basic structured division of the 2nd example of this invention.

[Drawing 5] It is the perspective diagram showing the 1st conventional example.

[Drawing 6] It is the perspective diagram showing the 2nd conventional example.

[Description of Notations]

2 Transmitting Section Circuit

3 Receive-Section Circuit

4 Light Emitting Device

5 Photo Detector

11 Circuit Board

12 2nd Circuit Board

21, 22 Semiconductor device

30 Thermolysis Section

40 Case

51, 52 Pewter

60 Terminal

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[Translation done.]



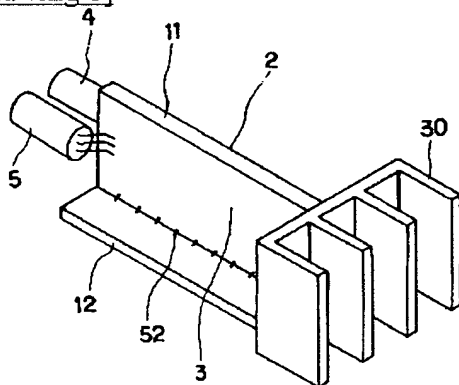
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## DRAWINGS

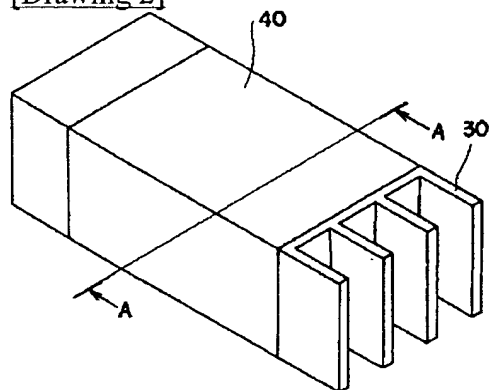
[Drawing 1]



- |           |              |
|-----------|--------------|
| 2 : 送信部回路 | 11 : 回路基板    |
| 3 : 受信部回路 | 12 : 第2の回路基板 |
| 4 : 発光素子  | 30 : 放熱部     |
| 5 : 受光素子  |              |

本発明の第1の実施例の基本構造部分を示す斜視図

[Drawing 2]



本発明の第1の実施例の外観を示す斜視図

[Drawing 3]

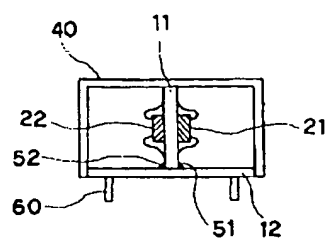
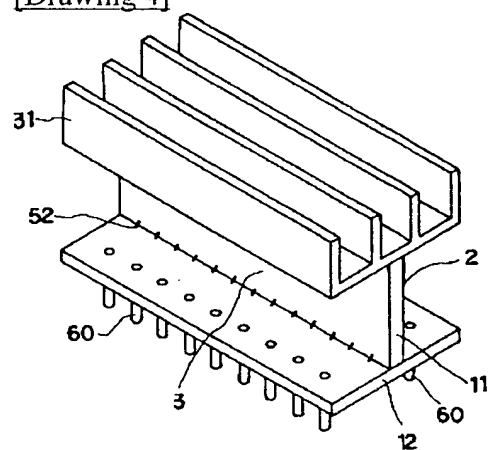


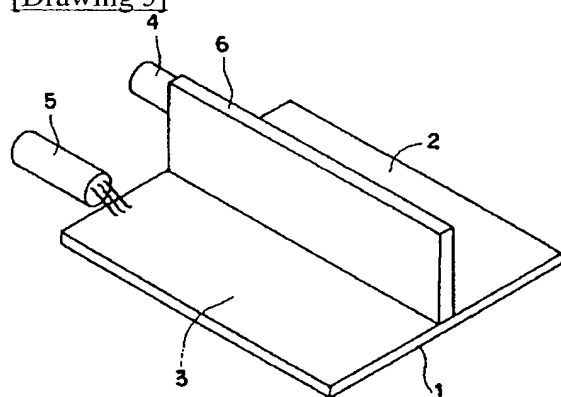
図 2 の A - A 線断面図

[Drawing 4]



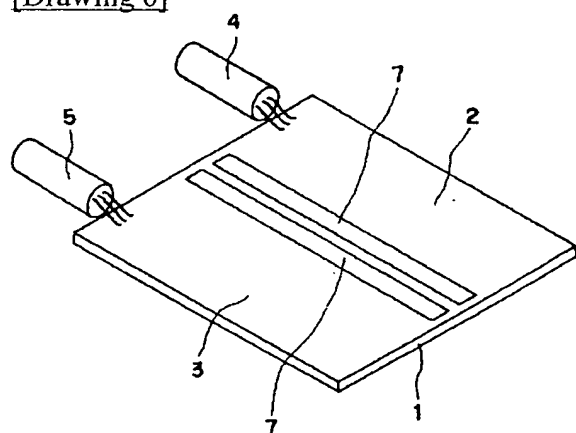
本発明の第 2 の実施例の基本構造部分を示す斜視図

[Drawing 5]



第 1 の従来例を示す斜視図

[Drawing 6]



第 2 の従来例を示す斜視図

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[Translation done.]